

WE CLAIM:

1. An apparatus comprising:
 - an elongate central venous catheter having a distal region configured for insertion into a patient's vasculature, and a fluid delivery lumen configured to allow a fluid to be delivered through the central venous catheter to the patient's vasculature;
 - an ultrasound assembly configured to be positioned adjacent to the central venous catheter distal region; and
 - a temperature sensor configured to measure a temperature in a region adjacent to the ultrasound assembly.
2. The apparatus of Claim 1, wherein the ultrasound assembly comprises an ultrasound radiating member mounted on an elongate support structure configured to be passed through the central venous catheter.
3. The apparatus of Claim 1, wherein the ultrasound assembly comprises an ultrasound radiating member mounted on the central venous catheter.
4. The apparatus of Claim 1, wherein the ultrasound assembly comprises a plurality of ultrasound radiating members.
5. The apparatus of Claim 1, wherein the temperature sensor is a thermocouple.
6. The apparatus of Claim 1, wherein central venous catheter has an outer diameter between approximately 6 French and approximately 14 French.
7. A method for removing a blockage from a central venous catheter comprising:
 - inserting an ultrasound assembly into a central venous catheter, the ultrasound assembly comprising an ultrasound radiating member mounted on an elongate support structure;
 - positioning the ultrasound assembly within the central venous catheter such that the ultrasound radiating member is adjacent to a deposited material formed on a portion of the central venous catheter;
 - supplying an electrical current to the ultrasound radiating member to expose the deposited material to ultrasonic energy; and

passing a blockage removal compound through the central venous catheter to expose the deposited material to the blockage removal compound simultaneously with ultrasonic energy.

8. The method of Claim 1, wherein the ultrasound assembly comprises a plurality of ultrasound radiating members.

9. The method of Claim 1, wherein the ultrasound assembly comprises a plurality of ultrasound radiating members, and wherein the plurality of ultrasound radiating members are individually controllable.

10. The method of Claim 1, further comprising measuring a temperature in a region adjacent to the ultrasound radiating member.

11. The method of Claim 1, further comprising:

measuring a temperature in a region adjacent to the ultrasound radiating member; and

adjusting the electrical current supplied to the ultrasound radiating member based on the measured temperature.

12. The method of Claim 1, wherein the blockage removal compound is also passed through the central venous catheter before ultrasonic energy is supplied to the deposited material.

13. A method comprising exposing a deposited material formed on a central venous catheter to ultrasonic energy while the central venous catheter is positioned in a patient and exposing the deposited material formed on the central venous catheter to a blockage removal compound while the central venous catheter is positioned in a patient.

14. The method of Claim 13, wherein the blockage removal compound comprises an antibacterial solution.

15. The method of Claim 13, wherein the ultrasonic energy has a frequency between about 20 kHz and about 20 MHz.

16. The method of Claim 13, the blockage removal compound comprises a thrombus removing agent.

17. The method of Claim 13, wherein the blockage removal compound is also delivered to the deposited material before ultrasonic energy is supplied to the deposited material.

18. The method of Claim 13, wherein the ultrasonic energy is also delivered to the deposited material after termination of the delivery of blockage removal compound to the deposited material.

19. The method of Claim 13, wherein the ultrasonic energy is delivered from an ultrasound assembly positioned within a central lumen of the central venous catheter.

20. The method of Claim 13, wherein the ultrasonic energy is delivered from an ultrasound assembly positioned within a central lumen of the central venous catheter, and wherein the ultrasound assembly comprises an ultrasound radiating member mounted on an elongate support structure.

21. The method of Claim 13, wherein the ultrasonic energy is delivered from an ultrasound assembly positioned within a central lumen of the central venous catheter, and wherein the ultrasound assembly comprises a plurality of ultrasound radiating members mounted on an elongate support structure.

22. The method of Claim 13, further comprising measuring a temperature adjacent to the deposited material.

23. The method of Claim 13, further comprising:
measuring a temperature adjacent to the deposited material; and
adjusting the amount of ultrasonic energy delivered to the deposited material based on the measured temperature.

24. The method of Claim 13, wherein the ultrasonic energy is delivered from an ultrasound radiating member embedded in an elongate body of the central venous catheter.

25. The method of Claim 13, wherein the blockage removal compound is delivered to the deposited material through the central venous catheter.

26. The method of Claim 13, wherein the blockage removal compound is delivered to the deposited material through a delivery lumen formed integrally with the central venous catheter.

27. A method for removing a deposited material from a catheter comprising:

supplying a therapeutic compound to the deposited material;

exposing the deposited material to ultrasonic energy generated by an ultrasound radiating member positioned within the catheter; and

measuring a temperature on the catheter to provide an indication of progression of the removal of the deposited material from the catheter.

28. The method of Claim 27, wherein the therapeutic compound comprises an antibacterial solution.

29. The method of Claim 27, wherein the deposited material is exposed to ultrasonic energy and therapeutic compound simultaneously.

30. The method of Claim 27, wherein the catheter comprises a central venous catheter.

31. The method of Claim 27, wherein the ultrasound radiating member is positioned within a central lumen of the catheter.

32. The method of Claim 27, wherein the ultrasound radiating member is embedded within an elongate body of the catheter.

33. The method of Claim 27, further comprising adjusting the amount of ultrasonic energy delivered to the deposited material based on the measured temperature.